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ABSTRACT

Change Group Analysis is suggested as a technique for examining the correlates of the differential effects of a compensatory education program within the group of enrolled pupils. It is based on using pretest-posttest relative changes for forming criterion groups and then using multiple disciminant analysis to uncover patterns of predictor variables among relevant demographic, cognitive, and affective measures. The technique's potential for avoiding reliance on the artifactual properties of both regression phenomena and gain scores is discussed. It is suggested that the technique would be useful when post hoc matching or covariance analysis might produce misleading or even erroneous conclusions about the overall effectiveness of an intervention program. A confirmatory empirical study is proposed. (Author)

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A SUGGESTED APPROACH FOR EXAMINING THE EFFECTS OF A COMPENSATORY EDUCATION PROGRAM

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Abstract

A technique for examining the correlates of the differential effects of a compensatory education program within the group of enrolled pupils is suggested. It is based on using pretest-posttest relative changes for forming "criterion" groups and then using multiple discriminant analysis to uncover patterns of "predictor" variables among relevant demographic, cognitive, and affective measures. The technique's potential for avoiding reliance on the artifactual properties of both regression phenomena and gain scores is discussed. It is suggested that the technique would be useful when post hoc matching or covariance analysis might produce misleading or even erroneous conclusions about the overall effectiveness of an intervention program. A confirmatory empirical study is proposed.

Problem Statement

Analyses of the benefits of compensatory education programs have usually been directed toward describing the overall effect of these programs on the entire groups of enrolled pupils. That is, the post-treatment performance of these pupils on some criterion measure is compared with their pre-treatment performance on that same measure or with the performance of some contrast group. Indeed, in some of the more elegant designs, both pre-post absolute changes and the performance of some constrast group might be employed. These evaluation strategies are enticingly simple and

straightforward, but they potentially can lead to biased, and even incorrect, conclusions. This point will be elaborated upon later in this paper.

At the moment, however, it is more appropriate to proceed with the main purpose of this paper, which is to suggest an alternate evaluation strategy. This is a technique for discovering the correlates of relatively different success patterns within the group of pupils enrolled in the program. The assumptions are that (a) not all of the pupils will have benefited equally from the treatment and (b) there are meaningful and systematic correlates of these differential success patterns. The proposed technique is addressed to such questions as, "What kinds of pupils, from which sorts of homes, receiving what types of instruction in which sorts of programs, and in what kinds of communities, do relatively well (or poorly) in Program Such-and-Such?"

Method

This proposed technique, "Change Group Analysis" (CGA), is a combination of a simple ranking procedure and a powerful multivariate analytic method. Pupils are ranked on the basis of their performance on one of the customary pre- and post-treatment measures, such as an achievement test. Then the distributions of these measures are divided into equal numbers of pupils. For expository purposes, they are here divided into thirds, as in Figure 1. In practice, the

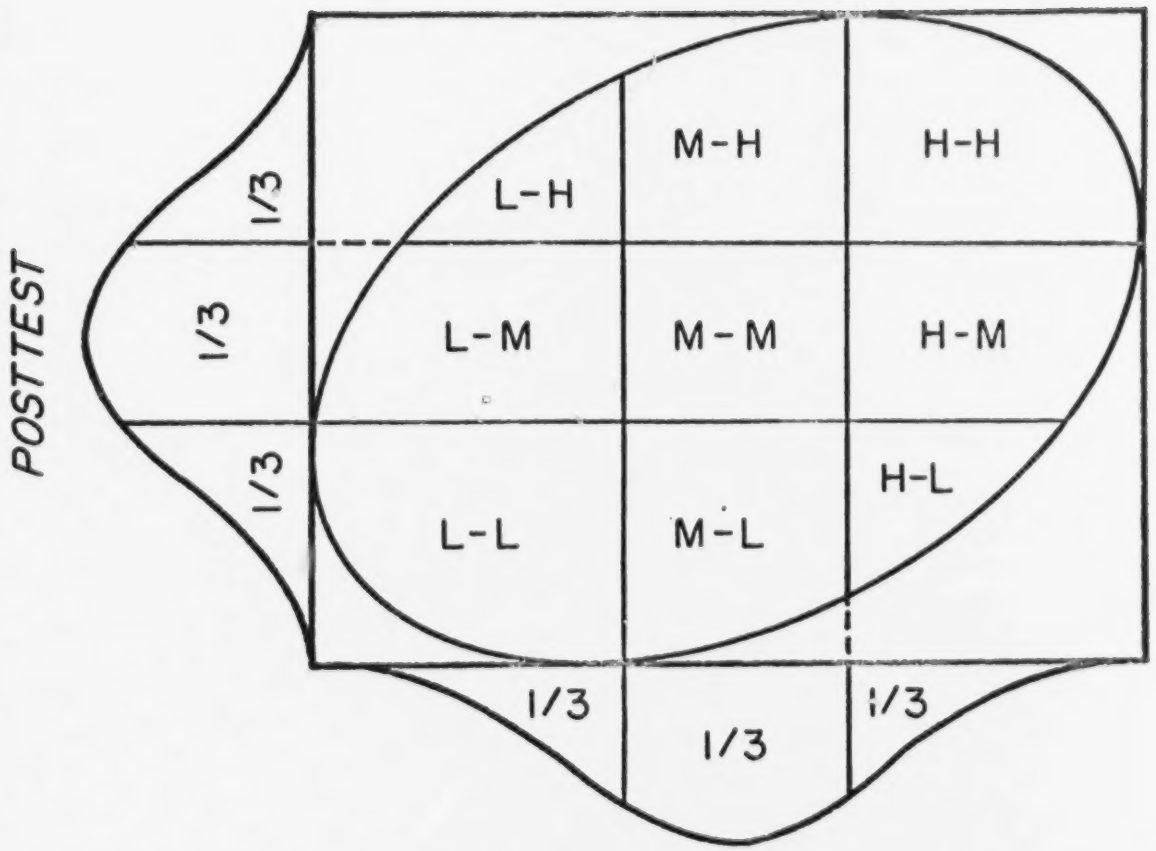

FIGURE I. CHANGE GROUPS

number of splits to be made would depend on both the number of pupils involved and the strength and shape of the relationship between the marginal variables. The bivariate distribution, when the marginals are split into thirds, is thus divided into up to nine "Change Groups" (CGs). The designations, "low-low" (L-L), "low-middle" (L-M), and so forth, indicate the initial and final relative positions of the members of each CG.

Next, all of the available and possibly relevant data on the pupils are used as "predictor" variables for multiple discriminant analysis (Cooley & Lohnes, 1962; Rao, 1952; Tatsuoka & Tiedeman, 1954), seeking maximum discrimination among the CGs. Potential predictor variables include the wealth of demographic data typically gathered in compensatory education evaluation: those on the pupils themselves, their families, teachers, schools, and communities. These data also include the cognitive and affective measures obtained in the course of the intervention program. Indeed, the variables used for forming the CGs for one CGA are potential predictor variables for other CGAs.

Discussion

The discussion of CGA must begin with what it is not. That is because, at first glance, CGA might appear to be a device for capitalizing on regression effects or for performing an analysis on gain scores without taking into account the methodological problems associated with gain

scores.

When two tests are imperfectly correlated, examinees below the mean on one test are predicted, through the use of a linear regression equation, to be below the mean on the other test, but not as far below, in standard deviation units. This predicted statistical "regression toward the mean" may or may not actually occur in fact (Hays & Winkler, 1970). When it does, we term it a "regression effect." When persons are selected for an experiment (or for an intervention program) because they deviate from the mean on some measure or on a variable related to that measure, and when that same measure is used as a posttest, these regression effects may then provide sources of invalidity for the interpretation of the results of the experiment (Campbell & Stanley, 1963).

But in CGA, it is the pupils' relative scores, rather than their absolute scores, that are used as the basis of the pupils' CG assignments. Neither a systematic movement of the group as a whole toward its population mean nor an artifactual constriction of the posttest variance would affect these relative standings.

On the other hand, suppose that the pupils in the program were members of different populations, with population parameters. If regression effects were then operating, the members of the various populations would be regressing toward different means and would be doing so at

different rates. This introduces a dilemma. Considering all of the participating pupils to be members of the same population, one in which there are meaningful subgroups whose combinations of personal and program demographic, cognitive, and affective attributes lead to different relative changes, is the purpose of CGA. Even if all or part of these patterns of change are due to different regression effects, the fact is that these changes still will have taken place. This is the dilemma: are these differential change patterns the result of the varying sensitivities of different subgroups to the treatment manifolds or is it merely that a complexity of different regression effects is being observed? It may very well be that the extent to which program- and teacher-related variables relate to CG membership will determine which hypothesis will be accepted.

Although the regression-effects question is one of obvious complexity, that surrounding the utilization of change scores is simpler. The methodological problems associated with the interpretation of change scores is well documented. See, for instance, Harris (1964). But, since CGA relies on changes in relative, rather than absolute, performance, it is not, strictly speaking, based on change scores. If it were, and if it were the bivariate distribution, not the marginals, that were divided, the CGs would be formed as in Figure 2. But with the CGs formed as

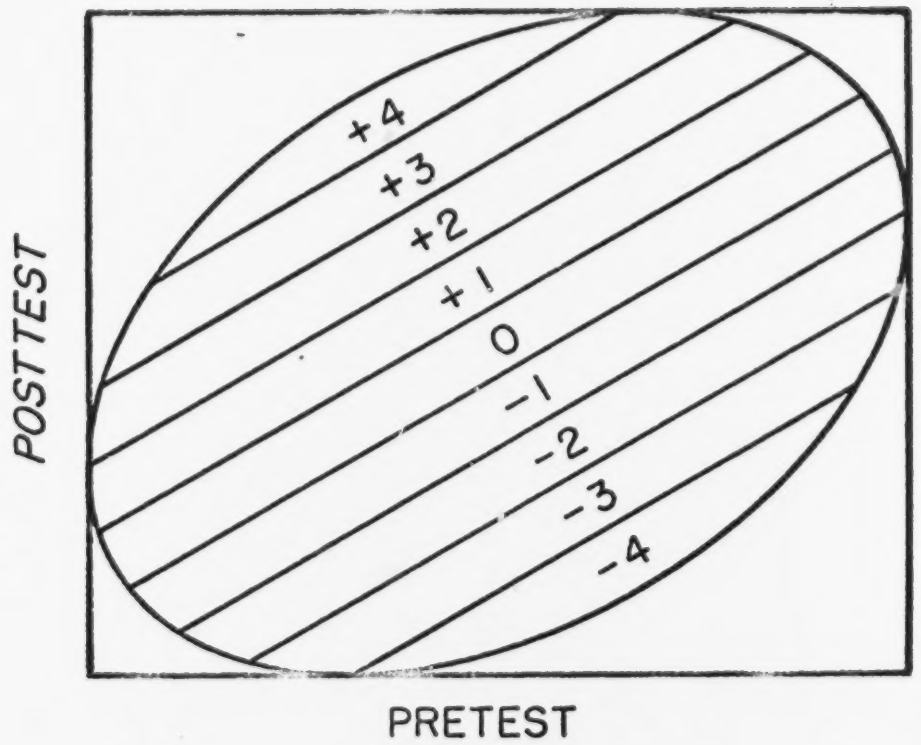

FIGURE 2. GROUPS FORMED ON THE BASIS OF GAIN SCORES

in Figure 1, L-L, M-M, and H-H are considered to be separate groups, although the members will have had approximately equal change scores (if the pretest and posttest scores are related in a linear fashion). This is also obviously true for those in L-M and M-H and also for those in M-L and H-M. With multiple discriminant analysis, the differences among all of the CGs are maximized. That is, the intent is to separate L-L and M-M, which will have had somewhat similar performances, as much as L-H and H-L, whose performances will have differed greatly.

As already mentioned, the use of relative standings obviates the assumption of linearity of regression of posttest on pretest. It should also be noted that these measures need not be assumed to have attained an interval scale.

At the outset of this paper, it was suggested that CGA be employed for examining the relative differential effects of a compensatory program within the group of enrolled pupils, somewhat as a supplement to the more traditional approaches which focus on the absolute performances of those in the group as a whole, usually comparing the group performance with that of some contrast group. Often either this contrast group is selected through a post hoc matching technique or else the data analysis is performed with covariance analysis. For some time, the problems of interpretation following post hoc matching have been well

known (Campbell & Stanley, 1963). But covariance analysis can also lead to misleading and even erroneous conclusions (Campbell & Erlebacher, in press; Lord 1967, 1969). The point here is that CGA might provide the only suitable alternative for evaluation of a program when the evaluator is faced with a necessary but completely ex post facto investigation.

Further Research

The next step is to perform CGA on some real data. Artificially-generated data would be unsatisfactory because the rules for generating these data would have to be too deterministic. In any event, a very large number of pupils, on each of whom a great many relevant measures are available, would be needed. This would normally be the case with CGA. It is intended for the evaluation of projects that are large-scale, at least regional, if not national, in scope. For a confirmatory study, an even greater-than-usual number of pupils will be needed. The reason is that this group should be randomly divided such that two or more parallel CGAs could be performed. The agreement of the results obtained therefrom would provide evidence for the consistency of the technique.

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